

# PATENT ABSTRACTS OF JAPAN

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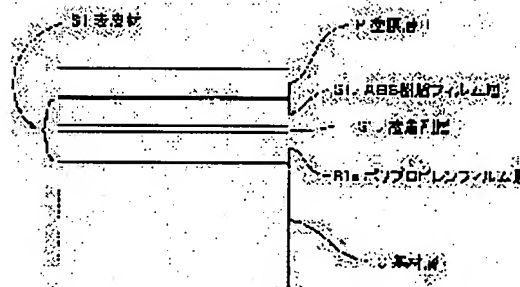
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## (54) IN-MOLD COATING MOLDING METHOD

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide an in-mold coating molding method for forming a strongly and closely bonded coating film simultaneously with molding within a mold by using a conventional coating, which is developed for a part of a thermoplastic resin and a thermosetting resin such as an ABS resin or the like, in the in-mold coating molding of an olefinic resin such as polypropylene or polyethylene incapable of closely bonding a coating film heretofore in the conventional coating.

**SOLUTION:** A skin material excellent in the adhesion with a paint to be used is used to perform laminate molding to mold a molded article having the skin material laminated on its surface in a mold. Next, a coating is injected in the gap between the surface of the laminated molded article and the surface of the mold cavity of the mold to coat the surface of the laminated molded article with the coating film and this coating film is cured in the mold to take out the molded article. By this constitution, the molded article having a coating film having strong adhesion formed on its surface integrally is obtained.



## LEGAL STATUS

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the so-called coat shaping approach in metal mold (the in mould coating approach) which forms a paint film in the product side of an injection-molded product within metal mold, loses a limit of a molding material class usable as synthetic resin for base materials, and relates to the coat shaping approach in metal mold which can use the synthetic-resin molding material of mold goods optimal in activity eye.

[0002]

[Description of the Prior Art] After the conventional coat shaping approach in metal mold injection molds a synthetic-resin molding material, by pouring in a coating into the metal mold Cover with the coat of a coating the product side of the synthetic-resin mold goods which it injection molded, obtain the mold goods with which the paint film was formed in the product side in one within metal mold, and it aims at upgrading on the front face of mold goods, and the cutback of painting processes. It is used for manufacture of a shell plate, exterior parts, etc. in the high auto industry of whenever [ especially to an appearance and surface quality / demand ].

[0003]

[Problem(s) to be Solved by the Invention] However, from the reasons of the hardening property which hardens the coating used for coat shaping in metal mold of thermoplastics at low temperature rather than the coating for thermosetting resin being searched for, generally development of the coating which has the appearance of a paint film, adhesion, etc. is difficult, and already having been developed as a coating used for the coat shaping approach in metal mold is limited to the coating for some [, such as Nylon and ABS plastics, ] thermoplastics, or the coating for thermosetting resin. For this reason, the actual condition is that the class of synthetic resin applicable to the coat shaping approach in metal mold is limited to some of thermoplastics or thermosetting resin, such as Nylon and ABS plastics. Furthermore, also in the future, it is thought on the structure of resin that it is technical very difficult to develop the coating which has sufficient adhesion to olefin system resin like polypropylene resin or polyethylene resin. This invention is in the development situation of the above coatings, there is nothing about a limit of a molding material class usable as synthetic resin for base materials in coat shaping in metal mold, and things are made into a technical problem. The olefin system resin to which a paint film was not able to be stuck in the conventional coatings, such as polypropylene resin and polyethylene resin, It aims at offering the coat shaping approach in metal mold which can form the paint film which has firm adhesion in the product side within metal mold at shaping and coincidence using the coating developed as Nylon, ABS plastics, or an object for thermosetting resin.

[0004]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, it sets to invention of the 1st of this invention. In the coat shaping approach in metal mold of obtaining the mold goods with which the paint film was formed in the product side in one within metal mold After performing lamination shaping using the synthetic-resin molding material used as the epidermis material

excellent in adhesion with a coating, and a base material, The mold goods with which the paint film was formed in the product side in one were obtained by pouring in a coating between the anti-base material side front face of said epidermis material, and the metal mold cavity front face which counters this, covering the anti-base material side front face of said epidermis material with the coat of said coating, and stiffening this coat within metal mold.

[0005] In the 2nd invention which makes 1st invention a subject, the synthetic-resin molding material used as a base material was used as polypropylene resin or polyethylene resin. Moreover, in the 3rd invention which makes the 1st and 2nd invention a subject, it considered as the epidermis material in which the base material side front face of epidermis material has the constructional detail which can be welded by the anchor effect to a base material, and the anti-base material side front face of said epidermis material has the constructional detail which can be pasted up by the anchor effect to a paint film.

[0006] In the 4th invention which makes the 1st and 2nd invention a subject, it considered as the epidermis material which epidermis material is multilayer structure, and the construction material of the base material side surface layer of this multilayer-structure epidermis material is synthetic resin with high compatibility to a base material, and the construction material of the anti-base material side surface layer of said multilayer-structure epidermis material becomes from synthetic resin with high compatibility to a paint film. Moreover, in the 5th invention which makes 4th invention a subject, the base material side front face of multilayer-structure epidermis material considered as the epidermis material which has the constructional detail which can be pasted up by the anchor effect to a base material.

[0007]

[Embodiment of the Invention] Based on a drawing, the example of this invention is explained to a detail below. The sectional view of the mold goods obtained by shaping in which each of drawing 1 - drawing 3 starts the example of this invention, drawing 1 is shown in the whole coat shaping equipment block diagram in metal mold, and drawing 2 is shown in an example 1, and drawing 3 are the sectional views of the mold goods obtained by shaping shown in an example 2.

[0008] As shown in drawing 1, the coat shaping equipment 100 in metal mold in the example of this invention consists of mold clamp equipment 10, injection equipment 20, a control unit 30, and metal mold 50, when a general-purpose toggle type injection molding machine is used and divided roughly. Mold clamp equipment 10 consists of that the movable head 12 which is equipped with the stationary platen 11 and the movable head 12 furnished with metal mold 50, and is guided at a tie rod 14, and is \*\* (ed) by the mold locking cylinder 13 approximately moves to stationary platen 11 so that metal mold 50 may be opened and closed.

[0009] Along with the inner skin of the cylinder-like barrel 22, revolution actuation is carried out by the hydraulic motor 23, and the screw 21 which has the spiral-like flight section is arranged free [ order \*\* ] by injection equipment 20. The resin pellet supplied in the hopper 25 with the revolution of a screw 21 is sent ahead of a screw 21, and a resin pellet fuses it by receiving the kneading operation by screw revolution while it receives heating at the heater (graphic display abbreviation) attached in the peripheral face of a barrel 22 in the meantime. When the amount of the melting resin sent ahead of the screw 21 reaches the amount set up beforehand, while suspending revolution actuation of a hydraulic motor 23, the melting resin stored ahead [ screw 21 ] is injected into the metal mold cavity 53 of metal mold 50 via a nozzle 26 by driving the injection cylinder 24 and advancing a screw 21.

[0010] Metal mold 50 is equipped with the fixed metal mold 51 attached in said stationary platen 11, and the movable die 52 attached in said movable head 12, and the coating impregnation machine 55 which pours in a coating into the metal mold cavity 53 is arranged by the movable die 52. In addition, although the product extractor for taking out the epidermis material feeder and mold goods for setting epidermis material to the metal mold cavity 53 is arranged around metal mold 50, in drawing 1, the graphic display of a feeder and product extractor is omitted.

[0011] Next, the configuration of a control unit 30 is described. As shown in drawing 1, the output signal from the shaping device control section 31 is sent to the mold clamp control section 33 and the

injection control section 38, and it is constituted so that each actuation of mold clamp equipment 10 and injection equipment 20 may be interlocked. The mold clamp control section 33 checking the operating state of mold clamp equipment 10 in response to each detecting signal from the mold opening volume sensor 17, the mold-locking-force sensor 18, and the paint pressure sensor 54, it is constituted so that each motion-control signal equivalent to a closing motion rate, timing of operation, mold opening volume, and mold locking force may be sent to the servo valve 15 for mold clamps in response to the output signal from the input condition setting-out section 32. Similarly, the injection control section 38 checking the operating state of injection equipment 20, it is constituted so that a motion-control signal may be sent to the servo valve 27 for injection. On the other hand, the impregnation mechanism section 35 is constituted so that each motion-control signal equivalent to an injection rate, grouting velocity, impregnation timing, and transfer pressure may be sent to the coating impregnation machine 55 in response to the output signal from the input condition setting-out section 32.

[0012] The coat shaping equipment 100 in metal mold constituted as mentioned above explains the activity at the time of performing coat shaping in metal mold. A motion-control signal is sent to the servo valve 15 for mold clamps from the mold clamp control section 33, carrying out feedback control according to the mold closing rate pattern set as the input condition setting-out section 32, a movable die 12 is advanced from a mold open limit position by the mold locking cylinder 13, and the fixed metal mold 11 is made to touch, after setting epidermis material to the metal mold cavity 53 by the epidermis material feeder which is not illustrated where a movable die 12 is held to a mold open limit position.

[0013] Then, a motion-control signal is sent to the servo valve 15 for mold clamps from the mold clamp control section 33, performing feedback control according to the mold-locking-force pattern set as the input condition setting-out section 32, a movable die 12 is further advanced by the mold locking cylinder 13, and predetermined mold locking force is made for a tie rod 14 to act on a stretch and metal mold 50. In predetermined timing of operation, if a screw 21 is advanced in the injection cylinder 24, controlling the servo valve 27 for injection by the motion-control signal sent from the injection control section 38, the melting resin currently stored ahead of the screw 21 will go via a nozzle 26, and it will inject and fill up with it in the metal mold cavity 53. The melting resin with which it injected and filled up in the metal mold cavity 53 is united with the epidermis material set to the metal mold cavity 53, it is cooled within metal mold 50, and a lamination injection-molded product is formed.

[0014] Next, a motion-control signal is sent to the servo valve 15 for mold clamps from the mold clamp control section 33. After retreating a movable die 12 by the mold locking cylinder 13 and preparing the front face of a lamination injection-molded product, and the clearance of the mold opening volume set as the input condition setting-out section 32 between the 53rd page of metal mold cavities, According to the injection rate of the coating impregnation machine 55 set as the input condition setting-out section 32, grouting velocity, impregnation timing, and transfer pressure, the coating impregnation machine 55 is controlled by the motion-control signal sent from the impregnation mechanism section 35, and a coating is poured in into the metal mold cavity 53.

[0015] Then, a motion-control signal is sent to the servo valve 15 for mold clamps from the mold clamp control section 33, a movable die 12 is again advanced by the mold locking cylinder 13, and feedback control is made to perform according to the mold opening volume pattern and mold-locking-force pattern which were set as the input condition setting-out section 32. While making the coating poured in by carrying out like this die and cross to all the front faces of a lamination injection-molded product, the process condition optimal for the appearance and adhesion reinforcement of a paint film is given.

[0016] A motion-control signal is sent to the servo valve 15 for mold clamps from the mold clamp control section 33 after it, carrying out feedback control to the timing of operation set as the input condition setting-out section 32 according to a mold aperture rate pattern, a movable die 12 is retreated to a mold open limit position by the mold locking cylinder 13, mold goods are really picked out from metal mold 50, and a series of molding cycles are completed.

[0017] [Example 1] Using the epidermis sheet of a three-tiered structure which consists of a polypropylene film layer / an adhesives layer / an ABS-plastics film layer, beforehand, in front of shaping, as the product side side of mold goods became an ABS-plastics film, what carried out reserve

size enlargement to the abbreviation metal mold configuration was used as epidermis material. The metal mold of 300mm long, the side of 210mm, a depth of 50mm, and the SHIEA edge structure where a thickness 2.7mm box-like product is obtained was used, and the die temperature performed lamination injection molding in polypropylene resin (J706MA:MFRmade from grand polymer = 15), after 85 degrees C and barrel temperature allotted said epidermis material by which set it as 200 degrees C and reserve size enlargement was carried out to the metal mold cavity and carried out the load of the 200t of the mold locking force. Ten cc (coating which has an adhesive property to ABS plastics) of coatings of the ordinary temperature which consists of a presentation given [ metal mold ] in a table 1 after [ of a metal mold halt ] 0.5mm aperture and 5 seconds after [ of the completion of injection ] 30 seconds is poured in by transfer pressure 1MPa, the load of closing and the 20t of the mold locking force was continuously carried out for metal mold for 2 minutes after [ of impregnation ] 2 seconds, after the completion of hardening of a coating, metal mold was opened and mold goods with a paint film were taken out. At this time, it checked that the coating had not adhered to a metal mold cavity front face.

[0018] The laminating of the epidermis material S1 which shows the cross section of the obtained mold goods to drawing 2, and consists of polypropylene film layer S1a and adhesives layer S1b and ABS-plastics film layer S1c on the base material layer C is carried out, and the laminating of the coat P is further carried out on the epidermis material S1. And it checked that polypropylene film layer S1a had stuck to the base material layer C well, and Coat P had stuck to ABS-plastics film layer S1c well. Furthermore, it is JIS about the adhesive strength of Coat P. 1mm width-of-face squares Scotch tape trial of K-5400 (the coating commercial-test approach) publication estimated, and it checked that it was in a good adhesion condition.

[0019] [Example 2] Using the same metal mold as an example 1, the shaping resin ingredient, and the coating, using the nonwoven fabric made from the polyethylene terephthalate of amount of superintendent officers 120 g/m<sup>2</sup> which gave the superintendent officer of a polyethylene terephthalate fiber to front flesh-side both sides as epidermis material, it fabricated on conditions as well as an example 1, and mold goods with a paint film were obtained. At this time, it checked that the coating had not adhered to a metal mold cavity front face.

[0020] The cross section of the obtained mold goods is shown in drawing 3, the laminating of the epidermis material (nonwoven fabric) S2 is carried out on the base material layer C, and the laminating of the coat P is further carried out on the epidermis material (nonwoven fabric) S2. And it is in the condition that impregnation of the superintendent officer fiber section of front flesh-side both sides of the epidermis material (nonwoven fabric) S2 was incorporated and carried out into the base material layer C and Coat P, and checked that the base material layer C, the epidermis material (nonwoven fabric) S2 and the epidermis material (nonwoven fabric) S2, and Coat P had stuck well by the anchor effect of the superintendent officer fiber section. Furthermore, the adhesive strength of the paint film which adhered on the surface of mold goods by 1mm width-of-face squares Scotch tape trial was evaluated, and it checked that it was in a good adhesion condition.

[0021] [Example 1 of a comparison] Where it considered as the same temperature conditions and coating impregnation conditions and the load of the 200t of the mold locking force is carried out to metal mold using the same metal mold as an example 1, polypropylene resin (J706MA:MFRmade from grand polymer = 15) was injected, and the ten cc of the same coatings as an example 1 was poured in for metal mold after [ of a metal mold halt ] 0.5mm aperture and 5 seconds after [ of the completion of injection ] 30 seconds. The load of closing and the 20t of the mold locking force was continuously carried out for metal mold for 2 minutes after [ of impregnation ] 2 seconds, after the completion of hardening of a coating, metal mold was opened and mold goods were taken out. Almost all coatings remained in the metal mold inner surface, and it did not stick, but only by touching a hand, the paint film which had adhered to mold goods slightly separated simply, and fell.

[0022]

[A table 1]

塗 料 の 組 成	重 量 部
ウレタンアクリレートオリゴマー (MW=2500)	100.0
トリプロピレングリコールジアクリレート	57.0
スチレン	3.0
酸化チタン	150.0
カーボンブラック	0.1
ステアリン酸亜鉛	1.7
8%コバルトオクトエート	0.5
ビス (4- <i>t</i> -ブチルシクロヘキシル)	2.5
パーオキシカーボネート	

[0023] As mentioned above, according to the coat shaping approach in metal mold of this invention, although a paint film can be stuck to ABS plastics, the coating which was not able to be made to stick a paint film to polypropylene resin can be used, and the polypropylene resin mold goods with which the paint film was formed in one in the state of good adhesion can be obtained. As mentioned above, although the example explained, this invention is not limited to said example and can be variously carried out in the range which does not deviate from the summary of this invention. For example, although that which preformed the epidermis sheet of a three-tiered structure which consists of a polypropylene film layer / an adhesives layer / an ABS-plastics film layer was used as epidermis material in the above-mentioned example 1, the epidermis sheet which has not preformed, and the various multilayer-structure epidermis sheets with which construction material differs can be used as epidermis material. Although similarly the nonwoven fabric made from the polyethylene terephthalate of amount of superintendent officers 120 g/m<sup>2</sup> which gave the superintendent officer of a polyethylene terephthalate fiber was used for front flesh-side both sides in the above-mentioned example 2 as epidermis material which has the constructional detail which can be pasted up by the anchor effect, the nonwoven fabric with which the amounts of superintendent officers differ, the nonwoven fabric with which construction material differs, and the various resin sheets which prepared many heights in the front face can be used. Moreover, in the above-mentioned example, in addition to this, \*\*\*\* for coatings which has an adhesive property to ABS plastics can use the coating for Nylon, and the coating for heat-curing resin, and can apply various resin ingredients also about the synthetic-resin molding material used as a base material.

[0024]

[Effect of the Invention] As stated above, the following outstanding effectiveness is demonstrated in this invention.

- (1) By using the epidermis material excellent in adhesion with a coating, the mold goods to which a paint film was not able to be stuck and with which the paint film was formed in one in the state of good adhesion can be conventionally obtained, for example in coat shaping in metal mold of olefin system resin. Therefore, the synthetic-resin molding material of mold goods optimal in a class and activity eye can be used as resin for base materials.
- (2) The coating for the conventional coat shaping in metal mold developed as Nylon, ABS plastics, or an object for thermosetting resin can be used.
- (3) According to the class of synthetic-resin ingredient used as a base material, the class of coating, a class, the purpose of use of mold goods, etc., it can be used out of the epidermis material from which construction material differs, the epidermis material from which the constructional detail of a surface layer differs, and the epidermis material which is multilayer structure further and combined various construction material and constructional details of a surface layer, being able to choose the optimal epidermis material.

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[Translation done.]

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CLAIMS

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[Claim(s)]

[Claim 1] In the coat shaping approach in metal mold of obtaining the mold goods with which the paint film was formed in the product side in one within metal mold After performing lamination shaping using the synthetic-resin molding material used as the epidermis material excellent in adhesion with a coating, and a base material, By pouring in a coating between the anti-base material side front face of said epidermis material, and the metal mold cavity front face which counters this, covering the anti-base material side front face of said epidermis material with the coat of said coating, and stiffening this coat within metal mold The coat shaping approach in metal mold characterized by obtaining the mold goods with which the paint film was formed in the product side in one.

[Claim 2] The coat shaping approach in metal mold according to claim 1 characterized by the synthetic-resin molding material used as a base material being polypropylene resin or polyethylene resin.

[Claim 3] The coat shaping approach in metal mold according to claim 1 or 2 characterized by being that in which the base material side front face of epidermis material has the constructional detail which can be welded by the anchor effect to a base material, and the anti-base material side front face of said epidermis material has the constructional detail which can be pasted up by the anchor effect to a paint film.

[Claim 4] The coat shaping approach in metal mold according to claim 1 or 2 that epidermis material is multilayer structure, and the construction material of the base material side surface layer of this multilayer-structure epidermis material is synthetic resin with high compatibility to a base material, and construction material of the anti-base material side surface layer of said multilayer-structure epidermis material is characterized by being synthetic resin with high compatibility to a paint film.

[Claim 5] The coat shaping approach in metal mold according to claim 4 characterized by the base material side front face of multilayer-structure epidermis material being what has the constructional detail which can be pasted up by the anchor effect to a base material.

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[Translation done.]